MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

TGD2151 – COMPUTER GRAPHICS FUNDAMENTALS
TCS2111 - COMPUTER GRAPHICS

(All sections / Groups)

Question No.	Marks
1	
2	
3	
4	
Total	

28 FEBRUARY 2017
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question Paper consists of 7 pages with 4 Questions only.

2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers CLEARLY in this Question Paper.

QUESTION 1

a) Given a flat surface with normal vector $(2, 5, 1)$, determine whether the surface is visible to:
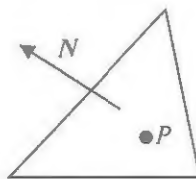   i) Viewer A looking at direction $(4, 0, 1)$.   [1.5 marks]
    ii) Viewer B looking at direction $(4, -2, 1)$.   [1.5 marks]

b) Find the plane equation for a triangle with normal vector $N = (2, 5, 1)$ and a point $P (1, 0, 7)$ falls on the triangle as illustrated below.   [2 marks]
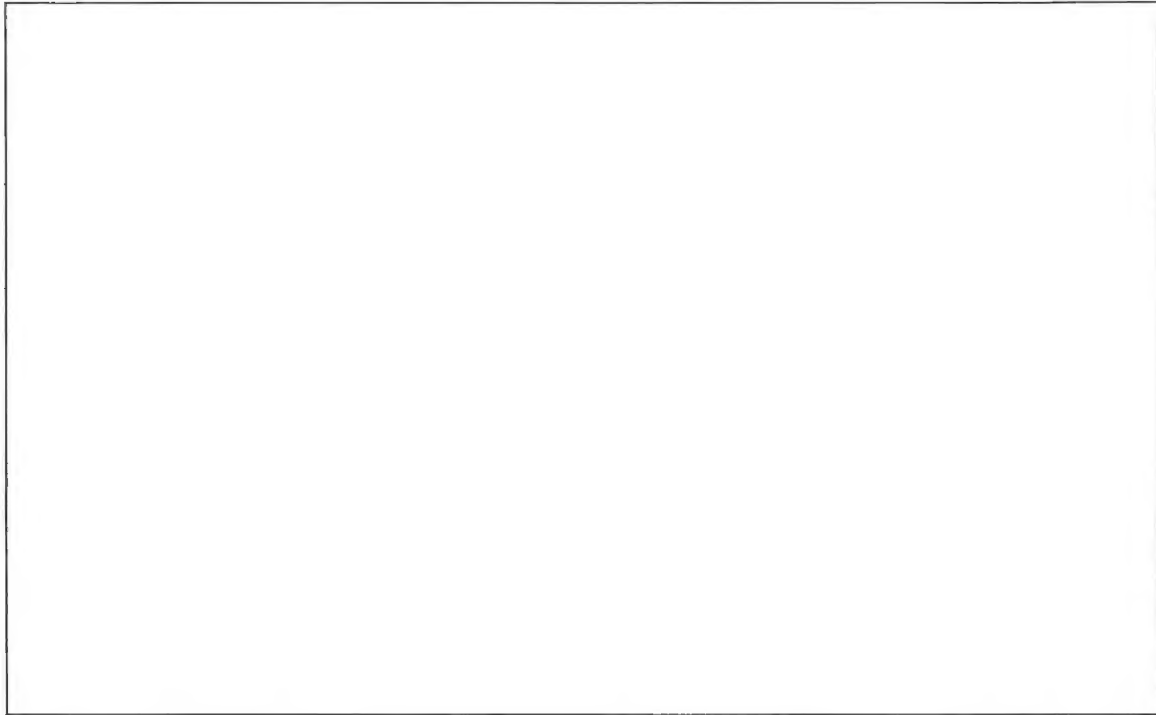

c) Given the pixel display region, using Z-buffer algorithm, determine the rendering of a red quad that covers the region in dotted line below and with the equation $2x + 3y - z = 2$. Assume that the background of the display is in black color. [Instruction: Let **R** to be red color and **B** to be black color]   [5 marks]

-1	-1	-1	-1
-1	-1	-1	-1
-1	-1	-1	-1
-1	-1	-1	-1

Z- buffer

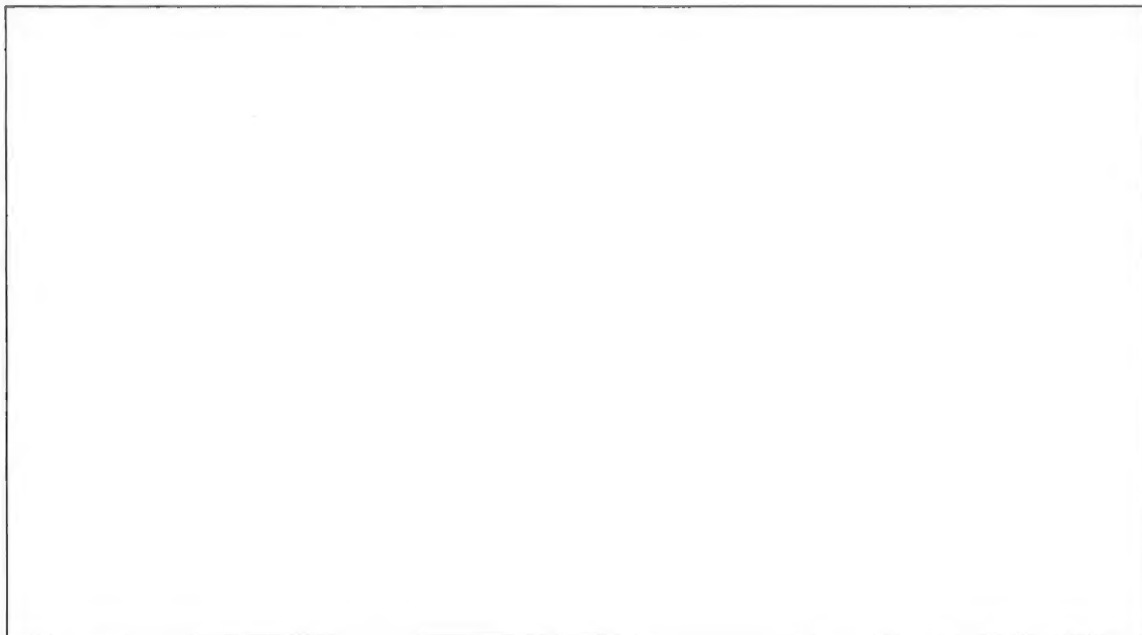| B	B	B	B
B	B	B	B
B	B	B	B
B	B	B	B

Frame buffer

QUESTION 2

a)   Define the following: [3 marks]
      i) Global Illumination
      ii) Diffuse reflection
      iii) Specular reflection

b)   Compute the intensity of the ambient light and diffuse reflection at a cube if the unit light vector L is (-0.707, 0, 0.707), normal vector N is (0, 0, 1), intensity of the ambient and diffuse light are $I_a = 0.8$ and $I_d = 0.9$ respectively, and the coefficient of the ambient and diffuse light are $K_a = 0.5$ and $K_d = 0.5$.

[3 marks]

c)   Draw and label the **Parallel** projection and **Perspective** projection based on the following details:
Parallel projection: glOrtho(-2, 2, -3, 3, 0, 10);   [2 marks]
Perspective projection: gluPerspective(30, 2, 0, 10);   [2 marks]

Parallel projection	**Perspective** projection

QUESTION 3

a)   Given two pixel coordinates (1, 3) and (5, 4), complete the following table for the pixel coordinates in between the two pixels using Bresenham's algorithm below:

$$F_k < 0: \quad y_{k+1} = y_k \qquad \text{Hence,} \quad F_{k+1} = F_k + 2h$$

$$F_k \geq 0: \quad y_{k+1} = y_k + 1 \qquad \text{Hence,} \quad F_{k+1} = F_k + 2(h - w)$$

[3 marks]

$$F_0 = 2h - w$$

K	F_k	X_k	Y_k
0		1	3

b)   Compare the line drawing algorithm between Analytical method and Bresenham's algorithm. Give two comparisons.   [2 marks]

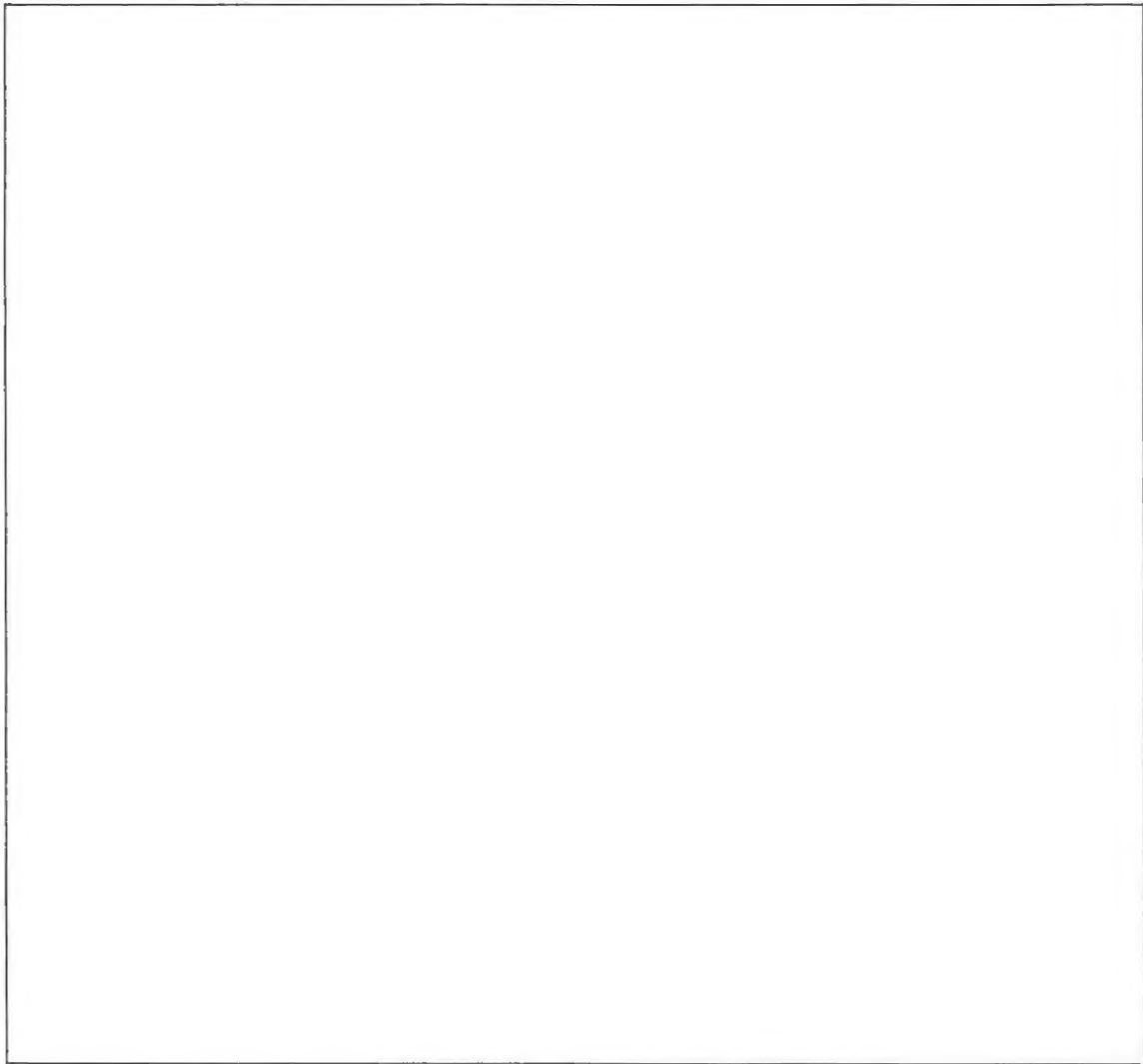| Analytical method	Bresenham's algorithm

c)   Cohen Sutherland's clipping algorithm is commonly used to solve the line clipping problems.

i) Sketch a diagram and specifies the clipping window and the corresponding region codes.   [2 marks]
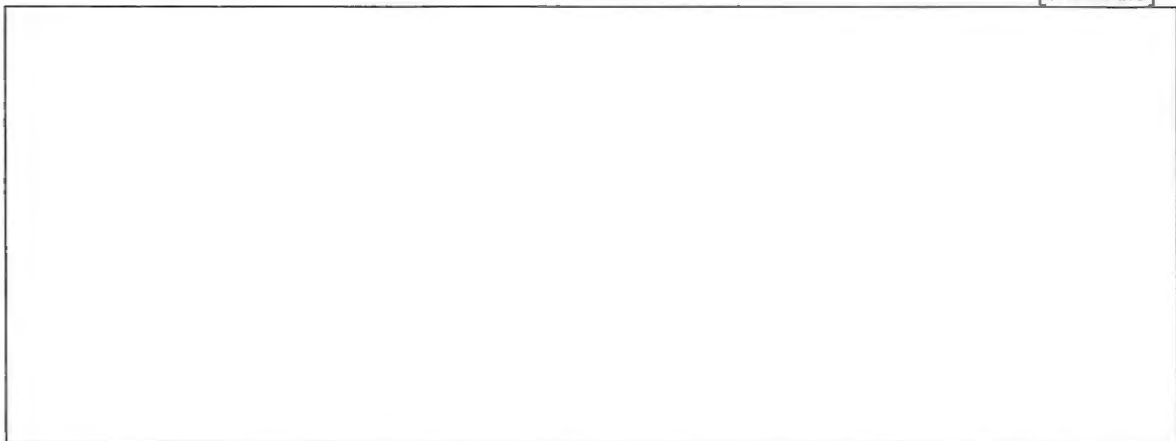
ii) Explain by examples that a line is in condition of "Trivial accept", "Trivial reject" and "Others".   [3 marks]
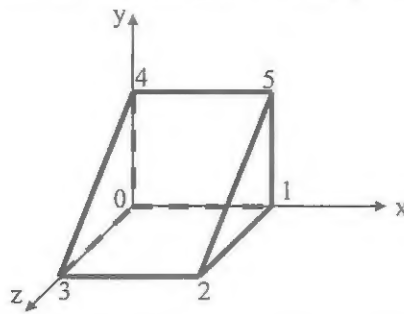
QUESTION 4

a)   Find a 2D composite matrix in homogeneous form if we rotate an object 90 degree anti-clock wise order about z-axis and translate the object by (4, 5).

[3 marks]

b)   i) Complete the Face List and Normal List for the object below.   [4 marks]

Face List					Normal List		
P_w	P_x	P_y	P_z		N_x	N_y	N_z
	2		4		0	0.577	0.577
	0		5				
	3		1				
	2		-1				
4	0	3	-1				

ii) Proof that the object is a polyhedron.   [1 mark]

c)   What is the frame buffer size in KB for the resolution 1280 by 640 that stores 8 bits per pixel?   [2 marks]

End of Page!